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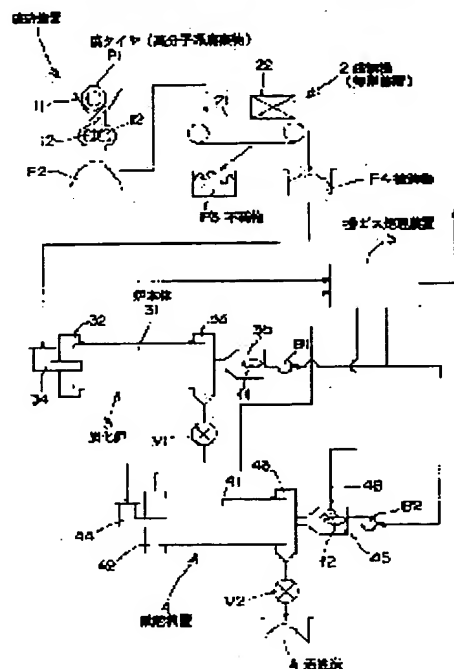
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(54) PRODUCTION EQUIPMENT FOR ACTIVATED CARBON



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a new production equipment, for an activated carbon, capable of economically producing a high quality activated carbon having a uniform size and quality in a high yield by a simple process compared with the conventional process from a waste high polymer-based material such as a waste tire and a waste plastic.

SOLUTION: This method for producing an activated carbon comprises crushing a high polymerbased waste material P1 before carbonization thereof to a corresponding size to the produced activated carbon by a crushing device 1, removing an incombustible impurity P3 contained in the crushed material by a selecting device 2, carbonizing the crushed material P4 from which the impurity P3 is removed, in a carbonizing furnace 3, and activating the carbonized material by an activating device 4 to produce the activated carbon A.

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CLAIMS

[Claim(s)]

[Claim 1] The shredding equipment crushed in the magnitude corresponding to the activated carbon which is the activated carbon manufacturing facility which carbonizes macromolecule system trash, is made to carry out activation further, and manufactures activated carbon, and manufactures the macromolecule system trash before carbonization, The activated carbon manufacturing facility characterized by having Sen another equipment from which the impurity which is contained in the debris obtained with shredding equipment, and which does not burn is removed, the carbonization furnace which carbonizes the debris from which the impurity was removed, and activation equipment which carries out activation of the carbide obtained at the carbonization furnace, and activated-carbon-izes it.

[Claim 2] The activated-carbon manufacturing facility according to claim 1 which is the rotary kiln which a carbonization furnace is equipped with the tubed furnace body to which the axis was turned almost horizontally, is contacted to the hot blast which writes the debris supplied in the furnace body concerned by rotating the above-mentioned axis as a core in this furnace body, and which was sent in in the furnace body concerned while conveying from the end of a furnace body to the other end, having *(ed) and preventing that welding, and is carbonized continuously.

[Claim 3] The activated carbon manufacturing facility according to claim 1 which is equipped with the offgas treatment equipment which collects inflammable components out of the exhaust gas which occurred by carbonization of the debris in a carbonization furnace and by which a carbonization furnace and activation equipment are operated by using as a fuel the inflammable component collected with this offgas treatment equipment.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacturing facility for manufacturing activated carbon from macromolecule system trash, such as for example, a waste tire and a waste plastic.

[0002]

[Description of the Prior Art] In order to reuse it as an effective resource rather than to only abandon the above-mentioned macromolecule system trash or to simply incinerate it like the former, various kinds of researches are done, it is the thing which carbonized the above-mentioned macromolecule system trash to one of them and to do for after activation, and there is a technique of manufacturing activated carbon useful as an adsorbent etc.

[0003] For example, it is made to carbonize, while being a form as it is, or making a dry distillation furnace put in, heat and distill the waste tire concerned dryly in the condition of having cut in the magnitude of 100mm angle extent, first and taking out carbonization gas and oil, in order to manufacture activated carbon from the waste tire which is macromolecule system trash. In order to take out the solid residue which remained after dry distillation from a dry distillation furnace and to make it into the magnitude corresponding to the activated carbon to manufacture next, it crushes by the crusher, and impurities which do not burn, such as a steel wire, are further removed using a **** machine etc.

[0004] From the carbide carbonized completely to a tar with imperfect carbonization, since the solid residue of this condition contains the thing of various carbonization conditions, next, it heats the above-mentioned solid residue at about 800 degrees C in a carbonization furnace, carries out carbonization processing again, and carbonizes that whole completely. And activated carbon will be manufactured, if the carbide obtained by the above-mentioned carbonization processing is contacted to the hot blast heated by about 900 degrees C including a steam using activation equipment and carries out activation.

[0005]

[Problem(s) to be Solved by the Invention] In manufacturing activated carbon at the above-mentioned process, there are the following troubles. Since it is first performed to ****, the dry distillation process at a dry distillation furnace supplying air extremely fewer than an air content required to carry out the perfect combustion of the macromolecule system trash, A reaction rate is essentially slow, and when requiring long duration, where air is intercepted, it becomes long duration (it is 6 hours or more at a track record), and the cause by which it is necessary to leave and cool and these things reduce the productivity of activated carbon, until it will be in the condition that charcoal does not remain in a furnace for insurance, about the dry

distillation furnace after reaction termination.

[0006] Watering in a furnace and cooling compulsorily is considered, and in this case, since solid residue will contain a lot of water of about 90% or more, in order that a desiccation process may be needed before a carbonization process, that installation cost, fuel cost, etc. may increase and a process may increase the top which is not economical, there is also a problem that the yield of activated carbon falls. Irrespective of the class of process, the decline in the yield of the activated carbon by the increment in a process is about about 5 – 10%, whenever 1 ** increases.

[0007] Moreover, since it distills dryly in the condition that 100mm angle extent is big even if a waste tire is a form as it is as mentioned above, or it cuts it, a front face is not fully carbonized to the interior, for example, even if carbonized. For this reason, among the solid residue which remains in the furnace after dry distillation, from the carbide completely carbonized as explanation of the previous production process instead of 100% of carbide also described components other than impurities which do not burn, such as a steel wire, the thing of various carbonization conditions is included to the tar with imperfect carbonization, and the tar especially with inadequate carbonization may remain about 50%.

[0008] and the part whose process the process of the re-carbonization at a carbonization furnace is required as mentioned above in the Prior art, and increases [that installation cost, fuel cost, etc.] and is not economical, and moreover increases that this should be carbonized completely since it cannot be used as a raw material of activated carbon if this tar remains as it is -- the yield of activated carbon will fall about 5 to 10% too. Moreover, since a tar has adhesiveness, in a crushing process, it adheres to a crusher, and the function of the crusher concerned is checked or removal of the impurity by a **** machine etc. which does not burn is checked.

[0009] For this reason, conventionally, in order to remove the impurity which does not burn, carbide and a tar are carried out the Sen exception manually first, carbide is covered over a **** machine, but about a tar, since the impurity which does not burn manually further is removed, the problem of being very bad also has working efficiency. On the other hand, the crushing and Sen exception, since carbide is weak, if external force, heat, etc. are received at each process of carbonization and activation, what serves as powder, without the magnitude corresponding to the activated carbon to manufacture being unmaintainable will occur so much. Since especially the carbide at the time of watering in a furnace and cooling compulsorily is still weaker than usual, the most will become powder.

[0010] For this reason, the activated carbon manufactured has the problem that particle size is not fixed. And the debris of the solid residue after the dry distillation which is the raw material of the above-mentioned activated carbon is in the condition before re-carbonization, and the top whose particle size is not fixed, since the thing of various carbonization conditions is included as mentioned above, the activated carbon to which dispersion was produced in the condition of carbonization, therefore activation of this carbide was carried out also already has the problem that quality is not fixed.

[0011] The purpose of this invention is to offer the new activated carbon manufacturing facility which is a easier process compared with the former and can manufacture high yield and the activated carbon of high quality to which magnitude and quality were equal economically from macromolecule system trash, such as for example, a waste tire and a waste plastic.

[0012]

[Means for Solving the Problem] The activated-carbon manufacturing facility of this invention

for solving the above-mentioned technical problem is characterized by to have the shredding equipment which crushes the macromolecule system trash before carbonization in the magnitude corresponding to the activated carbon manufacture, Sen another equipment from which the impurity which is contained in the debris which obtained with shredding equipment, and which does not burn removes, the carbonization furnace which carbonize the debris from which an impurity was removed, and activation equipment which carry out the activation of the carbide which obtained at a carbonization furnace, and activated-carbon-ize it.

[0013] According to the activated carbon manufacturing facility of this invention which consists of the above-mentioned configuration, there are the following advantages. First, in the activated carbon manufacturing facility of this invention, since two processings of removal of crushing by shredding equipment and the impurity by the equipment according to Sen which does not burn are performed to the macromolecule system trash of a good front even if it carbonizes, that magnitude of debris obtained is mostly fixed excluding a powdery thing etc.

[0014] And the above-mentioned debris is finely crushed to the magnitude (about 5mm angle extent) corresponding to the activated carbon manufactured as mentioned above. For this reason, the activated carbon by which the carbonization condition of each carbide is mostly fixed, carries out activation of the above-mentioned carbide, and the above-mentioned debris is manufactured by it while being completely carbonized to that interior by one carbonization processing at a carbonization furnace becomes the thing of the high quality to which magnitude and quality were equal.

[0015] Moreover, as mentioned above, since it completes by one carbonization processing at a carbonization furnace, according to this invention, carbonization of debris can reduce one process compared with the conventional method which requires two processes of dry distillation and re-carbonization for carbonization. And since the magnitude of debris is small as mentioned above, the time amount which the above-mentioned carbonization processing takes can be sharply shortened for about about 6 hours compared with the conventional dry distillation processing. Moreover, since the magnitude of debris is small, a large capacity of a carbonization furnace or activation equipment can be taken relatively and both equipments can be operated with allowances, the performance of equipment is stabilized and this also contributes to the stability and improvement in the quality of activated carbon.

[0016] Therefore, while being able to reduce an installation cost, fuel cost, etc. and being economical, the yield and quality of activated carbon improve and, moreover, the total processing time can also be shortened. Therefore, according to the activated carbon manufacturing facility of this invention, compared with the former, it becomes possible from macromolecule system trash, such as a waste tire and a waste plastic, to manufacture high yield and the activated carbon of high quality to which magnitude and quality were equal economically at a easier process, for example.

[0017] In addition, it is having the tubed furnace body to which the axis's was turned almost horizontally as the above-mentioned carbonization furnace, and rotating the above-mentioned axis for this furnace body as a core. It is desirable to use the rotary kiln which is contacted to the hot blast for which the debris supplied in the furnace body concerned is written, and which was sent in in the furnace body concerned, and is carbonized continuously, conveying from the end of a furnace body to the other end *(ing) and preventing the welding.

[0018] Since the carbonization processing of the debris concerned can be continuously carried out, preventing the welding of debris when this rotary kiln is used, manufacture effectiveness improves further. In addition, in order to manufacture the activated carbon of the magnitude

made into the purpose to crush the macromolecule system trash before carbonization in the magnitude corresponding to the activated carbon to manufacture as used in the field of this invention, it says crushing the macromolecule system trash before carbonization beforehand in more than this and magnitude without the need for crushing.

[0019] Moreover, in this invention, it is desirable to form the offgas treatment equipment which collects inflammable components out of the exhaust gas which occurred by carbonization of the debris in a carbonization furnace, and to operate a carbonization furnace and activation equipment by using as a fuel the inflammable component collected with this offgas treatment equipment. According to this configuration, there is an advantage that activated carbon can be manufactured, except the time of starting of a facility, without supplying most fuels from the exterior.

[0020]

[Embodiment of the Invention] It explains to it, referring to the drawing in which that example is shown for the gestalt of operation of the activated carbon manufacturing facility of this invention to below. The shredding equipment 1 crushed in the magnitude corresponding to the activated carbon which is for the activated carbon manufacturing facility of drawing 1 mainly using the waste tire P1 as a raw material, and manufacturing activated carbon, and manufactures the above-mentioned waste tire P1, The **** machine 2 as Sen another equipment which removes the impurities P3 which do not burn, such as a steel wire, from the debris P2 of a tire P1 obtained with this shredding equipment 1, The carbonization furnace 3 which carbonizes the debris P4 from which the impurity P3 which does not burn with the **** machine 2 was removed, While collecting inflammable components out of the exhaust gas which occurred by carbonization of the activation equipment 4 which carries out activation of the carbide obtained at this carbonization furnace 3, and manufactures activated carbon A, and the debris P4 in the carbonization furnace 3 After processing the exhaust gas which comes out of the above-mentioned carbonization furnace 3 and activation equipment 4, it has offgas treatment equipment 5 for emitting into atmospheric air.

[0021] Shredding equipment 1 is equipped with the hopper 11 which receives the waste tire P1, and the crushing rings 12 and 12 of a pair for [which rotates to hard flow mutually and crushes the waste tire P1] having been arranged under this hopper 11 among the above. Moreover, the **** machine 2 is equipped with the belt 21 which conveys the debris P2 obtained with the above-mentioned shredding equipment 1, and the electromagnet 22 arranged above this belt 21, with an electromagnet 22, carries out suction removal of the impurities P3 which do not burn, such as a steel wire, and obtains debris P4 from the debris P2 which has a belt 21 top conveyed.

[0022] The carbonization furnace 3 which carbonizes the above-mentioned debris P4 is the so-called rotary kiln, and as shown also in drawing 2 , it is equipped with the tubed furnace body 31 to which the axis was turned almost horizontally, the 1st frame 32 arranged so that end opening 31a of this furnace body 31 may be closed, and the 2nd frame 33 arranged so that other end opening 31b of the above-mentioned furnace body 31 may be closed.

[0023] Moreover, the feeder 34 for supplying debris P4 is formed in the above-mentioned furnace body 31 from the end opening 31a side, and the hot blast room 35 equipped with the burner B1 as a heat source for sending hot blast into the furnace body 31 from the other end opening 31b side is connected to the 2nd frame 33 at the 1st frame 32. Among the above, the 1st and 2nd frames 32 and 33 are being fixed [both] on the pedestal which is not illustrated, and exhaust-port 32a for sending the exhaust gas containing the volatile matter generated in case debris P4 is carbonized, a pyrolysis object, etc. to offgas treatment equipment 5 is formed

in the upper part of the 1st frame 32. Moreover, delivery 33a for discharging the carbide after processing out of equipment is prepared in the lower part of the 2nd frame 33, and this delivery 33a is connected with the feeder 44 of the activation equipment 4 mentioned later through the valve V1.

[0024] The furnace body 31 is making the annular tires 36 and 36 prepared in two places of the peripheral face contact the rollers 37 and 37 arranged free [rotation on said pedestal], it is laid free [rotation] on the roller 37 concerned and 37, and a rotation drive is carried out a core [an axis] by the source of power which is not illustrated. Moreover, spiral **--like 31c for conveying continuously to the other end opening 31b side, *(ing) which writes the debris P4 supplied by the feeder 34 is formed in the inner skin of the above-mentioned furnace body 31 for both-ends opening 31a and 31 b from the end opening 31a side at the time of rotation of the furnace body 31 concerned.

[0025] A burner B1 is mainly operated considering the inflammable component collected by offgas treatment equipment 5 as a fuel out of the exhaust gas which occurred by carbonization of the debris P4 in the carbonization furnace 3. However, in the time of starting of a facility etc., it is desirable to carry out to the ability of a burner B1 to be operated by the usual petroleum system fuel in consideration of the case where the above-mentioned inflammable components run short. In the above-mentioned carbonization furnace 3, while rotating the furnace body 31 with constant speed first, a burner B1 is lit. The sign f1 in drawing 1 and 2 shows the flame of a burner B1.

[0026] Next, if debris P4 is supplied to the furnace body 31 from the end opening 31a side with a feeder 34, *(ing), it is conveyed to the other end opening 31b side, and in that case, by the flame of said burner B1, it will generate in the hot blast room 35, and the debris P4 concerned will contact the hot blast which is written by said spiral protruding line 31c and which was sent in in the furnace body 31, and will be carbonized continuously.

[0027] And the exhaust gas containing the volatile matter which the carbide obtained by the above-mentioned carbonization processing let the valve V1 pass from delivery 33a of the 2nd frame 33, and it was sent to the activation equipment 4 which is degree process, and was generated on the occasion of carbonization, a pyrolysis object, etc. is sent to offgas treatment equipment 5 from exhaust-port 32a of the 1st frame 32. The temperature of the hot blast for carbonizing debris P4, although especially the conditions of the carbonization processing at the above-mentioned carbonization furnace 3 are not limited has inadequate carbonization, and while preventing that a tar occurs, it is [that it should prevent that carbonization advances too much and ash content increases] desirable that it is about 800 degrees C on an average.

[0028] Moreover, as for the temperature of the above-mentioned hot blast, it is desirable to consider as about 800 degrees C in the range applied from the center section of about 900 degrees C and the furnace body 31 in more detail near the end opening 31a which is the outlet of hot blast and is the inlet port of debris P4 near the other end opening 31b of the furnace body 31 which is the outlet of a brown coal ghost at the inlet port of hot blast. Thus, if it is made more into an elevated temperature near the other end opening 31b of the furnace body 31 which is the outlet of carbide, there is an advantage that carbonization of debris P4 can much more be ensured.

[0029] What is necessary is just to adjust the thermal power and blast weight of a burner B1, in order to adjust the temperature of hot blast. Moreover, as for the above-mentioned hot blast, it is [that debris P4 should prevent burning and ashing] desirable that the surplus oxygen density is 5% or less. What is necessary is just to adjust the amount of oxygen supplied in case a fuel is

burned and hot blast is generated with a burner B1, in order to adjust the surplus oxygen density of hot blast.

[0030] Furthermore, its carbonization is inadequate, and it is desirable [time amount] to make for carbonization to advance too much and for ash content to increase into about about 30 – 60 minutes that it should prevent while the carbonization time amount of the debris P4 by contact to the above-mentioned hot blast prevents that a tar occurs. What is necessary is to adjust the rotational speed of the furnace body 31, or just to change the spiral include angle of protruding line 31c of the inside of the furnace body 31, in order to adjust carbonization time amount.

[0031] Fundamentally, the activation equipment 4 to which activation of the carbide obtained at the above-mentioned carbonization furnace 3 is carried out is the same rotary kiln as the carbonization furnace 3. That is, as shown also in drawing 3, it has the tubed furnace body 41 to which the axis was turned almost horizontally, the 1st frame 42 arranged so that end opening 41a of this furnace body 41 may be closed, and the 2nd frame 43 arranged so that other end opening 41b of the above-mentioned furnace body 41 may be closed.

[0032] Moreover, the feeder 44 for supplying carbide is formed in the above-mentioned furnace body 41 from the end opening 41a side, and the hot blast room 45 equipped with burner B-2 as a heat source for sending in the hot blast containing the steam for carrying out activation of the above-mentioned carbide is connected to the 2nd frame 43 from the other end opening 41b side at the 1st frame 42 at the furnace body 41.

[0033] Among the above, the 1st and 2nd frames 42 and 43 are being fixed [both] on the pedestal which is not illustrated, and exhaust-port 42a for sending the exhaust gas containing the evaporation object generated in case activation of the carbide is carried out, a pyrolysis object, etc. to offgas treatment equipment 5 is formed in the upper part of the 1st frame 42. Moreover, delivery 43a for discharging the activated carbon A after processing out of equipment through a valve V2 is prepared in the lower part of the 2nd frame 43.

[0034] The furnace body 41 is making the annular tires 46 and 46 prepared in two places of the peripheral face contact the rollers 47 and 47 arranged free [rotation on said pedestal], it is laid free [rotation] on the roller 47 concerned and 47, and a rotation drive is carried out a core [an axis] by the source of power which is not illustrated. Moreover, spiral **-like 41c for conveying continuously to the other end opening 41b side, **(ing) which writes the carbide supplied by the feeder 44 is formed in the inner skin of the above-mentioned furnace body 41 for both-ends opening 41a and 41 b from the end opening 41a side at the time of rotation of the furnace body 41 concerned.

[0035] As for burner B-2, it is desirable like the burner B1 of the carbonization furnace 3 for the usual petroleum system fuel to also enable operation of the inflammable component collected by offgas treatment equipment 5 out of the exhaust gas which occurred by carbonization of the debris P4 in the carbonization furnace 3 in consideration of the case where inflammable components run short too, mainly although operated as a fuel. The difference with the carbonization furnace 3 of the above-mentioned activation equipment 4 is a point that the piping 48 which supplies the hot water which becomes the origin of the steam for carrying out activation of the carbide is connected to the hot blast room 45.

[0036] In addition, the above-mentioned piping 48 is connected to offgas treatment equipment 5 as shown in drawing 1, and the hot water heated by the heat generated in case exhaust gas is processed in this offgas treatment equipment 5 so that it may mention later is supplied to the hot blast room 45 through piping 48. In the above-mentioned activation equipment 4, while rotating the furnace body 41 with constant speed first, burner B-2 is lit. And if hot water is

supplied from piping 48, this hot water will contact the flame f2 of burner B-2, and the hot blast containing a steam will occur.

[0037] Next, if carbide is supplied to the furnace body 41 from the end opening 41a side with a feeder 44, the carbide concerned will contact the hot blast containing the steam which is written by said spiral protruding line 41c and which was conveyed to the other end opening 41b side, was generated in said hot blast room 45, and was sent in in the furnace body 41 on that occasion, ~~the~~(ing). And activation of the carbide is carried out because about 15 – 30% of the front face of a carbide particle reacts with the above-mentioned steam, it evaporates and the front face concerned porosity-izes.

[0038] And the exhaust gas containing the evaporation object which the activated carbon A obtained by the above-mentioned activation processing was discharged out of equipment through the valve V2, was collected from delivery 43a of the 2nd frame 43 as a product, and was generated on the occasion of activation, a pyrolysis object, etc. is sent to offgas treatment equipment 5 from exhaust-port 42a of the 1st frame 42. Although especially the conditions of the activation processing by the above-mentioned activation equipment 4 are not limited, as for the temperature of the hot blast containing the steam for carrying out activation of the carbide, it is [that it should prevent that activation becomes inadequate] desirable that it is about 900 degrees C on an average.

[0039] Moreover, as for the temperature of the above-mentioned hot blast, it is desirable to consider as about 900 degrees C from the center section of about 1000 degrees C and the furnace body 41 in more detail in the range applied near the end opening 41a which is the inlet port of a brown coal ghost at the outlet of the hot blast containing a steam near the other end opening 41b of the furnace body 41 which is the inlet port of the hot blast containing a steam, and is the outlet of activated carbon. Thus, if it is made more into an elevated temperature near the other end opening 41b of the furnace body 41 which is the outlet of activated carbon, there is an advantage that activation of carbide can be performed much more certainly.

[0040] What is necessary is just to adjust the thermal power and blast weight of burner B-2, in order to adjust the temperature of hot blast. In order to acquire sufficient activation operation, as for the amount of the steam contained in hot blast, it is desirable that it is 50% or more. What is necessary is just to adjust an amount, and the burner B-2 thermal power and blast weight of the hot water supplied from piping 48, in order to adjust the amount of a steam.

[0041] Moreover, as for the above-mentioned hot blast, it is [that carbide should prevent burning and ashing] desirable that the surplus oxygen density is 5% or less. What is necessary is just to adjust the amount of oxygen supplied in case an oil is burned and hot blast is generated by burner B-2, in order to adjust the surplus oxygen density of hot blast. Furthermore, as for the activation time amount of the carbide by contact to the above-mentioned hot blast, it is desirable to make for activation to become inadequate into about about 30 – 50 minutes that it should prevent.

[0042] What is necessary is to adjust the rotational speed of the furnace body 41, or just to change the spiral include angle of protruding line 41c of the inside of the furnace body 41, in order to adjust activation time amount. The offgas treatment equipment 5 for processing said carbonization furnace 3 and the exhaust gas which occurred with the above-mentioned activation equipment 4 As shown in drawing 4 , the exhaust gas which occurred by carbonization of the debris P4 in the carbonization furnace 3 is cooled with cooling water. While mixing with air and burning the condensator 51 for collecting the oil J which is an inflammable component out of the exhaust gas concerned, the hydraulic reservoir 52 for storing the oil J

collected with the condenser 51, and exhaust gas after collecting oil After burning the exhaust gas which occurred with activation equipment 4 with the flame of this combustion, it has the secondary furnace 53 emitted into atmospheric air through chimney-stack 53b.

[0043] The oil J stored in the hydraulic reservoir 52 among the above is supplied to the burner B1 of the carbonization furnace 3 and activation equipment 4, and B-2 as a fuel as mentioned above. The secondary furnace 53 mixes furnace body 53a and exhaust gas after a condenser 51 recovers oil with the air from a blower b1. It has the burner B3 burned within the above-mentioned furnace body 53a, and chimney-stack 53b, and the component which remained in exhaust gas, without being recovered by the condenser 51 among the volatile matter and the pyrolysis objects which were generated from debris P4 in the carbonization furnace 3 is decomposed and removed by combustion with a burner B3 among the above.

[0044] Moreover, the exhaust gas which occurred with activation equipment 4 is supplied in furnace body 53a of the secondary furnace 53, as shown in drawing, contacts the flame of a burner B3, burns, and the evaporation object and pyrolysis object which are contained in the exhaust gas concerned and which are generated in the case of carbide activation are disassembled, and it is removed. And among drawing, the exhaust gas defanged by combustion at the above-mentioned secondary furnace 53 is emitted into atmospheric air through chimney-stack 53b, as a white arrow head shows.

[0045] Moreover, the heater 54 for heating water in the middle of the above-mentioned chimney-stack 53b with the heat of exhaust air passing through the inside of the chimney-stack 53b concerned is formed, and the hot water heated with this heater 54 is supplied to the hot blast room 45 of activation equipment 4 so that it may generate the steam to which activation of the carbide is carried out, as mentioned above. Since each part of the above which constitutes the facility concerned is all the thing of the continuous system instead of a batch type, the activated carbon manufacturing facility of drawing 1 has the advantage that activated carbon can be manufactured continuously. However, the shredding equipment which constitutes the activated carbon manufacturing facility of this invention, the equipment according to Sen, a carbonization furnace, and activation equipment may be batch types.

[0046] In addition, various design changes can be performed in the range which does not change the summary of this invention.

[0047]

[Effect of the Invention] As mentioned above, as explained in full detail, according to the activated carbon manufacturing facility of this invention, compared with the former, high yield and the activated carbon of high quality to which magnitude and quality were equal economically can be manufactured at a easier process from macromolecule system trash, such as a waste tire and a waste plastic, for example. Therefore, this invention does so the characteristic operation effectiveness of enabling reuse as a useful resource of the above-mentioned macromolecule system trash.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing an example of the gestalt of operation of the activated carbon manufacturing facility of this invention.

[Drawing 2] It is the sectional view of the carbonization furnace which constitutes the activated carbon manufacturing facility of drawing 1 .

[Drawing 3] It is the sectional view of the activation equipment which constitutes the activated carbon manufacturing facility of drawing 1 .

[Drawing 4] It is the block diagram of the offgas treatment equipment which constitutes the activated carbon manufacturing facility of drawing 1 .

[Description of Notations]

- 1 Shredding Equipment
- 2 Equipment according to Sen
- 3 Carbonization Furnace
- 31 Furnace Body
- 4 Activation Equipment
- 5 Offgas Treatment Equipment
- P1 Macromolecule system trash
- P3 Impurity
- P4 Debris
- A Activated carbon

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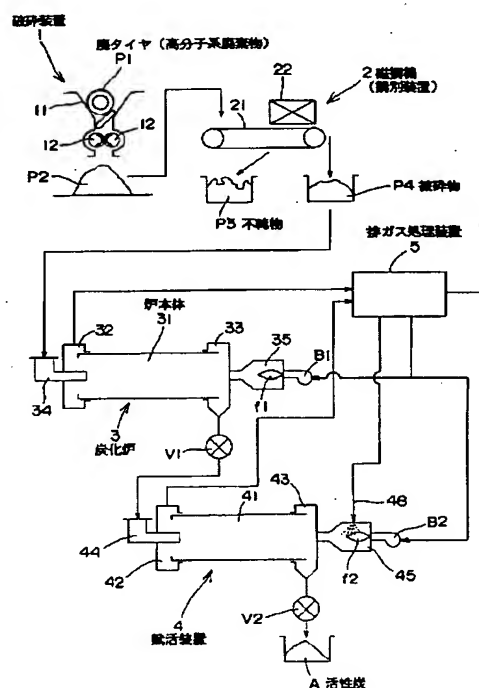
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(54) 【発明の名称】 活性炭製造設備

(57) 【要約】

【課題】 廃タイヤや廃プラスチック等の高分子系廃棄物から、従来に比べてより簡単な工程で、高収率かつ経済的に、大きさや品質の揃った、高品質の活性炭を製造しうる、新規な活性炭製造設備を提供する。

【解決手段】 炭化前の高分子系廃棄物 P 1 を、破碎装置 1 によって、製造する活性炭 A に対応する大きさに破碎し、この破碎物中に含まれる燃えない不純物 P 3 を選別装置 2 で除去し、不純物 P 3 が除去された破碎物 P 4 を、炭化炉 3 で炭化した後、炭化物を、賦活装置 4 で賦活して活性炭 A を製造する。



【特許請求の範囲】

【請求項1】高分子系廃棄物を炭化し、さらに賦活させて活性炭を製造する活性炭製造設備であって、炭化前の高分子系廃棄物を、製造する活性炭に対応する大きさに破碎する破碎装置と、破碎装置でえた破碎物中に含まれる燃えない不純物を除去する撰別装置と、不純物が除去された破碎物を炭化する炭化炉と、炭化炉でえた炭化物を賦活して活性炭化する賦活装置とを備えることを特徴とする活性炭製造設備。

【請求項2】炭化炉が、軸線をほぼ水平に向けた筒状の炉本体を備え、この炉本体を、上記軸線を中心として回転させることで、当該炉本体内に供給された破碎物をかく拌してその融着を防止しつつ、炉本体の一端から他端へ搬送しながら、当該炉本体内に送り込まれた熱風と接触させて連続的に炭化させるロータリーキルンである請求項1記載の活性炭製造設備。

【請求項3】炭化炉での破碎物の炭化により発生した排ガス中から、可燃性の成分を回収する排ガス処理装置を備えており、この排ガス処理装置で回収された可燃性の成分を燃料として、炭化炉および賦活装置が運転される請求項1記載の活性炭製造設備。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、たとえば廃タイヤや廃プラスチック等の高分子系廃棄物から、活性炭を製造するための製造設備に関するものである。

【0002】

【従来の技術】上記高分子系廃棄物を、これまでのようにただ単に投棄したり焼却したりするのではなく、有効な資源として再利用するために各種の研究が行われており、そのうちの一つに、上記高分子系廃棄物を炭化したのち賦活させることで、吸着剤等として有用な活性炭を製造する技術がある。

【0003】たとえば、高分子系廃棄物である廃タイヤから活性炭を製造するには、まず当該廃タイヤをそのままの形で、あるいは100mm角程度の大きさに切断した状態で、乾留炉に入れて加熱し、乾留させて、乾留ガスや油分を取り出すとともに、炭化させる。つぎに、乾留後に残った固形物残渣を乾留炉から取り出し、製造する活性炭に対応する大きさとするために破碎機によって破碎し、さらにスチールワイヤ等の燃えない不純物を磁撰機等を用いて取り除く。

【0004】この状態の固形物残渣は、完全に炭化した炭化物から、炭化が不完全なタール分まで、種々の炭化状態のものを含むため、つぎに上記固形物残渣を、炭化炉内で、約800℃に加熱して再び炭化处理して、その全体を完全に炭化させる。そして、上記炭化处理によってえられた炭化物を、賦活装置を用いて、水蒸気を含み、約900℃程度に加熱された熱風と接触させて賦活させると、活性炭が製造される。

【0005】

【発明が解決しようとする課題】上記の工程で活性炭を製造する場合には、下記のような問題点がある。まず乾留炉による乾留工程は、高分子系廃棄物を完全燃焼させるのに必要な空気量よりも極端に少ない空気を供給しつつ、除々に行われるため、本来的に反応速度が遅く、長時間を要する上、反応終了後の乾留炉を、安全のために、炉内に火種が残らない状態となるまで空気を遮断した状態で長時間（実績で6時間以上）、放置して冷却する必要もあり、これらのことが活性炭の生産性を低下させる原因となる。

【0006】炉内に撒水して強制的に冷却することも考えられるが、この場合には、固形物残渣が、およそ90%以上という多量の水を含むことになるので、炭化工程の前に乾燥工程が必要となり、その設備費や燃料費等がかさんで経済的でない上、工程が増えるために活性炭の収率が低下するという問題もある。工程の増加による活性炭の収率の低下は、工程の種類にかかわらず、1工程増えることにおよそ5～10%程度である。

【0007】また、たとえば廃タイヤは、前述したようにそのままの形で、あるいは切断したとしても100mm角程度の大きな状態で乾留されるため、表面は炭化されても内部まで十分に炭化されない。このため、乾留後の炉内に残る固形物残渣のうち、スチールワイヤ等の燃えない不純物以外の成分は100%の炭化物ではなく、先の製造工程の説明でも述べたように、完全に炭化した炭化物から、炭化が不完全なタール分まで、種々の炭化状態のものを含んでおり、とくに炭化が不十分なタール分は、およそ50%程度も残っている場合がある。

【0008】そしてこのタール分は、そのままでは活性炭の原料として使用できないので、これを完全に炭化すべく、従来の技術では、前述したように炭化炉による再炭化の工程が必要で、その設備費や燃料費等がかさんで経済的でなく、しかも工程が増える分、やはり活性炭の収率が5～10%程度も低下してしまう。またタール分は粘着性を有するので、破碎工程において破碎機に付着して、当該破碎機の機能を阻害したり、あるいは磁撰機等による燃えない不純物の除去を阻害したりする。

【0009】このため従来は、燃えない不純物を除去するために、まず炭化物とタール分を手作業で撰別し、炭化物は磁撰機にかけるが、タール分については、さらに手作業で燃えない不純物を除去しているため、作業効率がきわめて悪いという問題もある。一方、炭化物はもろいので、破碎、撰別、炭化および賦活の各工程で外力や熱等を受けると、製造する活性炭に対応する大きさを維持できずに粉状となるものが多量に発生する。とくに、炉内に撒水して強制的に冷却した場合の炭化物は、通常よりもさらにもろいため、そのほとんどが粉状になってしまう。

【0010】このため、製造される活性炭は、粒径が一

定しないという問題がある。しかも上記活性炭の原料である乾留後の固形物残渣の破砕物は、再炭化前の状態ですでに粒径が一定でない上、前述したように種々の炭化状態のものを含むため、炭化の状態にばらつきを生じ、したがってこの炭化物を賦活させた活性炭は品質が一定しないという問題もある。

【0011】この発明の目的は、たとえば廃タイヤや廃プラスチック等の高分子系廃棄物から、従来に比べてより簡単な工程で、高収率かつ経済的に、大きさや品質の揃った、高品質の活性炭を製造しうる、新規な活性炭製造設備を提供することにある。

【0012】

【課題を解決するための手段】上記課題を解決するための、この発明の活性炭製造設備は、炭化前的高分子系廃棄物を、製造する活性炭に対応する大きさに破砕する破砕装置と、破砕装置でえた破砕物中に含まれる燃えない不純物を除去する撰別装置と、不純物が除去された破砕物を炭化する炭化炉と、炭化炉でえた炭化物を賦活して活性炭化する賦活装置とを備えることを特徴としている。

【0013】上記構成からなる、この発明の活性炭製造設備によれば、下記のような利点がある。まず、この発明の活性炭製造設備においては、炭化してもろくなる前的高分子系廃棄物に対して、破砕装置による破砕と、撰別装置による燃えない不純物の除去の2つの処理を行っているため、えられた破砕物は粉状のもの等を含まず、その大きさがほぼ一定している。

【0014】しかも上記破砕物は、前述したように製造する活性炭に対応する大きさ（およそ5mm角程度）まで細かく破砕されている。このため上記破砕物は、炭化炉による1回の炭化処理により、その内部まで完全に炭化されるとともに、各炭化物の炭化状態がほぼ一定しており、上記炭化物を賦活して製造される活性炭は、大きさや品質が揃った高品質のものとなる。

【0015】また上記のように、破砕物の炭化は炭化炉による1回の炭化処理で完了するため、この発明によれば、炭化のために乾留と再炭化の2工程を要する従来法に比べて、工程を1つ削減できる。しかも、上記炭化処理に要する時間は、前記のように破砕物の大きさが小さいため、従来の乾留処理にくらべて大幅に、およそ6時間程度は短縮できる。また、破砕物の大きさが小さいため、相対的に炭化炉や賦活装置の容量を大きくとることができ、両装置を余裕をもって運転できるので、装置の運転性能が安定し、このことも、活性炭の品質の安定や向上に貢献する。

【0016】したがって、設備費や燃料費等を削減できて経済的であるとともに、活性炭の収率および品質が向上し、しかもトータルの処理時間も短縮できる。よって、この発明の活性炭製造設備によれば、たとえば廃タイヤや廃プラスチック等の高分子系廃棄物から、従来に

比べてより簡単な工程で、高収率かつ経済的に、大きさや品質の揃った、高品質の活性炭を製造することが可能となる。

【0017】なお上記炭化炉としては、軸線をほぼ水平に向けた筒状の炉本体を備え、この炉本体を、上記軸線を中心として回転させることで、当該炉本体内に供給された破砕物をかく拌してその融着を防止しつつ、炉本体の一端から他端へ搬送しながら、当該炉本体内に送り込まれた熱風と接触させて連続的に炭化させるロータリーキルンを使用するのが好ましい。

【0018】かかるロータリーキルンを使用した場合には、破砕物の融着を防止しつつ、当該破砕物を連続的に炭化処理できるので、さらに製造効率が向上する。なおこの発明でいう、炭化前的高分子系廃棄物を、製造する活性炭に対応する大きさに破砕するとは、目的とする大きさの活性炭を製造するために、炭化前的高分子系廃棄物を、これ以上、破砕の必要のない大きさに、あらかじめ破砕することをいう。

【0019】またこの発明においては、炭化炉での破砕物の炭化により発生した排ガス中から可燃性の成分を回収する排ガス処理装置を設け、かかる排ガス処理装置で回収された可燃性の成分を燃料として、炭化炉および賦活装置を運転するようにするのが好ましい。かかる構成によれば、設備の起動時以外はほとんど外部から燃料を補給することなく、活性炭を製造できるという利点がある。

【0020】

【発明の実施の形態】以下に、この発明の活性炭製造設備の実施の形態を、その一例を示す図面を参照しつつ説明する。図1の活性炭製造設備は、主に廃タイヤP1を原料として活性炭を製造するためのものであって、上記廃タイヤP1を、製造する活性炭に対応する大きさに破砕する破砕装置1と、この破砕装置1でえた、タイヤP1の破砕物P2から、スチールワイヤ等の燃えない不純物P3を除去する撰別装置としての磁撰機2と、磁撰機2で燃えない不純物P3を除去した破砕物P4を炭化する炭化炉3と、この炭化炉3でえた炭化物を賦活して活性炭Aを製造する賦活装置4と、炭化炉3での破砕物P4の炭化により発生した排ガス中から可燃性の成分を回収するとともに、上記炭化炉3および賦活装置4から出る排ガスを処理した後、大気中へ放出するための排ガス処理装置5とを備えている。

【0021】上記のうち破砕装置1は、廃タイヤP1を受けるホッパ11と、このホッパ11の下方に配置された、互いに逆方向に回転して廃タイヤP1を破砕するための、一対の破砕輪12、12とを備えている。また磁撰機2は、上記破砕装置1でえた破砕物P2を搬送するベルト21と、このベルト21の上方に配置された電磁石22とを備えており、ベルト21上を搬送される破砕物P2から、電磁石22によって、スチールワイヤ等の

燃えない不純物P3を吸引除去して破砕物P4をえるものである。

【0022】上記破砕物P4を炭化させる炭化炉3はいわゆるロータリーキルンであって、図2にも示すように、軸線をほぼ水平に向けた筒状の炉本体31と、この炉本体31の一端開口31aをふさぐように配置された第1の枠体32と、上記炉本体31の他端開口31bをふさぐように配置された第2の枠体33とを備えている。

【0023】また、第1の枠体32には、上記炉本体31に、一端開口31a側から破砕物P4を供給するための供給機34が設けられており、第2の枠体33には、炉本体31に、他端開口31b側から熱風を送り込むための熱源としての、バーナB1を備えた熱風室35が接続されている。上記のうち第1および第2の枠体32、33は、ともに図示しない基台上に固定されており、第1の枠体32の上部には、破砕物P4を炭化させる際に発生する揮発分や熱分解物等を含む排ガスを、排ガス処理装置5へ送るための排気口32aが形成されている。また第2の枠体33の下部には、処理後の炭化物を装置外へ排出するための吐出口33aが設けられており、この吐出口33aが、弁V1を介して、後述する賦活装置4の供給機44と接続されている。

【0024】炉本体31は、その外周面の2箇所に設けた環状のタイヤ36、36を、前記基台上に回転自在に配置されたローラ37、37に当接させることで、当該ローラ37、37上に回転自在に載置されており、図示しない動力源によって、軸線を中心として回転駆動される。また、上記炉本体31の内周面には、当該炉本体31の回転時に、一端開口31a側から供給機34によって供給された破砕物P4をかく拌しつつ、他端開口31b側へ連続的に搬送するためのらせん状の突状31cが、両端開口31a、31b間に亘って形成されている。

【0025】バーナB1は主に、炭化炉3での破砕物P4の炭化により発生した排ガス中から、排ガス処理装置5によって回収された可燃性の成分を燃料として運転される。ただし設備の起動時等において、上記可燃性の成分が不足する場合を考慮して、バーナB1は、通常の石油系燃料でも運転可能とするのが好ましい。上記炭化炉3においては、まず炉本体31を一定速度で回転させるとともに、バーナB1に着火する。図1、2中の符号f1はバーナB1の炎を示している。

【0026】つぎに、供給機34によって、一端開口31a側から破砕物P4を炉本体31に供給すると、当該破砕物P4は、前記らせん状の突条31cによってかく拌されつつ、他端開口31b側へ搬送され、その際に、前記バーナB1の炎によって熱風室35内で発生して、炉本体31内に送り込まれた熱風と接触して、連続的に炭化される。

【0027】そして、上記の炭化処理によってえられた炭化物は、第2の枠体33の吐出口33aから、弁V1を通して、次工程である賦活装置4に送られ、炭化の際に発生した揮発分や熱分解物等を含む排ガスは、第1の枠体32の排気口32aから、排ガス処理装置5へ送られる。上記炭化炉3による炭化処理の条件はとくに限定されないが、破砕物P4を炭化するための熱風の温度は、炭化が不十分でタール分が発生するのを防止するとともに、炭化が進行しすぎて灰分が増加するのを防止すべく、平均で800℃程度であるのが好ましい。

【0028】また上記熱風の温度は、より詳しくは、熱風の入口でかつ炭化物の出口である炉本体31の他端開口31bの近傍で900℃程度、炉本体31の中央部から、熱風の出口でかつ破砕物P4の入口である一端開口31aの近傍にかけての範囲で800℃程度とするのが好ましい。このように、炭化物の出口である炉本体31の他端開口31bの近傍をより高温にすれば、破砕物P4の炭化をより一層確実にできるという利点がある。

【0029】熱風の温度を調整するには、バーナB1の火力および送風量を調整すればよい。また上記熱風は、破砕物P4が燃焼して灰化するのを防止すべく、その余剰酸素濃度が5%以下であるのが好ましい。熱風の余剰酸素濃度を調整するには、バーナB1によって燃料を燃焼させて熱風を発生させる際に供給する酸素量を調整すればよい。

【0030】さらに、上記熱風との接触による破砕物P4の炭化時間は、炭化が不十分でタール分が発生するのを防止するとともに、炭化が進行しすぎて灰分が増加するのを防止すべく、およそ30～60分程度とするのが好ましい。炭化時間を調整するには、炉本体31の回転速度を調整するか、あるいは炉本体31の内面の突条31cの、らせんの角度を変更すればよい。

【0031】上記炭化炉3でえた炭化物を賦活させる賦活装置4は、基本的には、炭化炉3と同様のロータリーキルンである。すなわち図3にも示すように、軸線をほぼ水平に向けた筒状の炉本体41と、この炉本体41の一端開口41aをふさぐように配置された第1の枠体42と、上記炉本体41の他端開口41bをふさぐように配置された第2の枠体43とを備えている。

【0032】また、第1の枠体42には、上記炉本体41に、一端開口41a側から炭化物を供給するための供給機44が設けられており、第2の枠体43には、炉本体41に、他端開口41b側から、上記炭化物を賦活させるための、水蒸気を含む熱風を送り込むための熱源としての、バーナB2を備えた熱風室45が接続されている。

【0033】上記のうち第1および第2の枠体42、43は、ともに図示しない基台上に固定されており、第1の枠体42の上部には、炭化物を賦活させる際に発生する、気化物や熱分解物等を含む排ガスを、排ガス処理装

置5へ送るための排気口42aが形成されている。また第2の枠体43の下部には、処理後の活性炭Aを、弁V2を介して装置外へ排出するための吐出口43aが設けられている。

【0034】炉本体41は、その外周面の2箇所に設けた環状のタイヤ46、46を、前記基台上に回転自在に配置されたローラ47、47に当接させることで、当該ローラ47、47上に回転自在に載置されており、図示しない動力源によって、軸線を中心として回転駆動される。また、上記炉本体41の内周面には、当該炉本体41の回転時に、一端開口41a側から供給機44によって供給された炭化物をかく拌しつつ、他端開口41b側へ連続的に搬送するためのらせん状の突状41cが、両端開口41a、41b間に亘って形成されている。

【0035】バーナB2は、炭化炉3のバーナB1と同様に、主として、炭化炉3での破碎物P4の炭化により発生した排ガス中から、排ガス処理装置5によって回収された可燃性の成分を燃料として運転されるが、やはり可燃性の成分が不足する場合を考慮して、通常の石油系燃料でも運転可能とするのが好ましい。上記賦活装置4の炭化炉3との相違点は、炭化物を賦活させるための水蒸気の元になる熱水を供給する配管48が、熱風室45に接続されている点である。

【0036】なお上記配管48は、図1に示すように排ガス処理装置5に接続されており、後述するように、この排ガス処理装置5において排ガスを処理する際に発生する熱によって加熱された熱水が、配管48を通して熱風室45に供給される。上記賦活装置4においては、まず炉本体41を一定速度で回転させるとともに、バーナB2に着火する。そして、配管48から熱水を供給すると、この熱水がバーナB2の炎f2と接触して、水蒸気を含む熱風が発生する。

【0037】つぎに、供給機44によって、一端開口41a側から炭化物を炉本体41に供給すると、当該炭化物は、前記らせん状の突状41cによってかく拌されつつ、他端開口41b側へ搬送され、その際に、前記熱風室45内で発生して、炉本体41内に送り込まれた、水蒸気を含む熱風と接触する。そして、炭化物粒子の表面の約15～30%が上記水蒸気と反応して気化して、当該表面が多孔質化することで、炭化物が賦活される。

【0038】そして、上記の賦活処理によってえられた活性炭Aは、第2の枠体43の吐出口43aから、弁V2を通して装置外へ排出されて製品として回収され、賦活の際に発生した気化物や熱分解物等を含む排ガスは、第1の枠体42の排気口42aから、排ガス処理装置5へ送られる。上記賦活装置4による賦活処理の条件はとくに限定されないが、炭化物を賦活するための、水蒸気を含む熱風の温度は、賦活が不十分になるのを防止すべく、平均で900℃程度であるのが好ましい。

【0039】また上記熱風の温度は、より詳しくは、水

蒸気を含む熱風の入口でかつ活性炭の出口である炉本体41の他端開口41bの近傍で1000℃程度、炉本体41の中央部から、水蒸気を含む熱風の出口でかつ炭化物の入口である一端開口41aの近傍にかけての範囲で900℃程度とするのが好ましい。このように、活性炭の出口である炉本体41の他端開口41bの近傍をより高温にすれば、炭化物の賦活をより一層確実に行えるという利点がある。

【0040】熱風の温度を調整するには、バーナB2の火力および送風量を調整すればよい。熱風中に含まれる水蒸気量は、十分な賦活作用をえるために50%以上であるのが好ましい。水蒸気量を調整するには、配管48から供給される熱水の量と、バーナB2火力および送風量とを調整すればよい。

【0041】また上記熱風は、炭化物が燃焼して灰化するのを防止すべく、その余剰酸素濃度が5%以下であるのが好ましい。熱風の余剰酸素濃度を調整するには、バーナB2によって油を燃焼させて熱風を発生させる際に供給する酸素量を調整すればよい。さらに、上記熱風との接触による炭化物の賦活時間は、賦活が不十分になるのを防止すべく、およそ30～50分程度とするのが好ましい。

【0042】賦活時間を調整するには、炉本体41の回転速度を調整するか、あるいは炉本体41の内面の突状41cの、らせんの角度を変更すればよい。前記炭化炉3、および上記賦活装置4で発生した排ガスを処理するための排ガス処理装置5は、図4に示すように、炭化炉3での破碎物P4の炭化により発生した排ガスを冷却水によって冷却して、当該排ガス中から、可燃性の成分である油分Jを回収するための冷却器51と、冷却器51で回収された油分Jを貯蔵するための貯油槽52と、油分を回収した後の排ガスを空気と混合して燃焼させるとともに、この燃焼の炎によって、賦活装置4で発生した排ガスを燃焼させた後、煙突53bを通して大気中に放出する二次炉53とを備えている。

【0043】上記のうち貯油槽52に貯蔵された油分Jは、前記のように炭化炉3および賦活装置4のバーナB1、B2に燃料として供給される。二次炉53は、炉本体53aと、冷却器51で油分を回収した後の排ガスを送風機b1からの空気と混合して、上記炉本体53a内で燃焼させるバーナB3と、煙突53bとを備えており、上記のうちバーナB3での燃焼により、炭化炉3において破碎物P4から発生した揮発分や熱分解物のうち、冷却器51で回収されずに排ガス中に残留した成分が分解、除去される。

【0044】また賦活装置4で発生した排ガスは、図に示すように二次炉53の炉本体53a内に供給され、バーナB3の炎と接触して燃焼されて、当該排ガス中に含まれる、炭化物賦活の際に発生する気化物や熱分解物が分解、除去される。そして、上記二次炉53での燃焼に

より無害化された排ガスは、図中、白矢印で示すように煙突53bを通して大気中に放出される。

【0045】また、上記煙突53bの途中には、水を、当該煙突53b内を通る排気の熱によって加熱するための加熱器54が設けられており、この加熱器54で加熱された熱水が、前述したように、炭化物を賦活させる水蒸気を発生させるべく、賦活装置4の熱風室45に供給される。図1の活性炭製造設備は、当該設備を構成する上記各部がいずれもバッチ式でなく、連続式のものであるため、活性炭を連続的に製造できるという利点がある。ただしこの発明の活性炭製造設備を構成する破碎装置、選別装置、炭化炉、および賦活装置は、バッチ式であっても構わない。

【0046】その他、この発明の要旨を変更しない範囲で、種々の設計変更を施すことができる。

【0047】

【発明の効果】以上、詳述したようにこの発明の活性炭製造設備によれば、たとえば廃タイヤや廃プラスチック等の高分子系廃棄物から、従来に比べてより簡単な工程で、高収率かつ経済的に、大きさや品質の揃った、高品質の活性炭を製造できる。したがってこの発明は、上記高分子系廃棄物の、有用な資源としての再利用を可能と*

*するという、特有の作用効果を奏する。

【図面の簡単な説明】

【図1】この発明の活性炭製造設備の、実施の形態の一例を示すブロック図である。

【図2】図1の活性炭製造設備を構成する炭化炉の、断面図である。

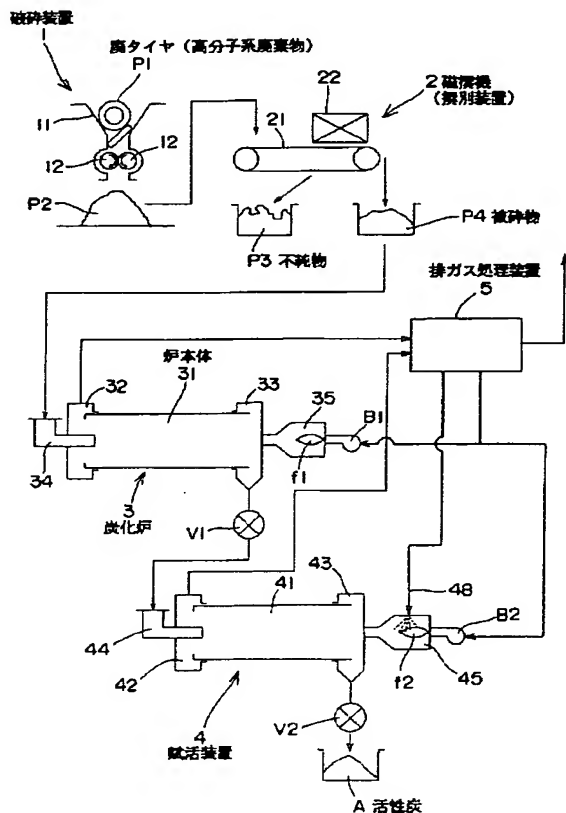
【図3】図1の活性炭製造設備を構成する賦活装置の、断面図である。

【図4】図1の活性炭製造設備を構成する排ガス処理装置のブロック図である。

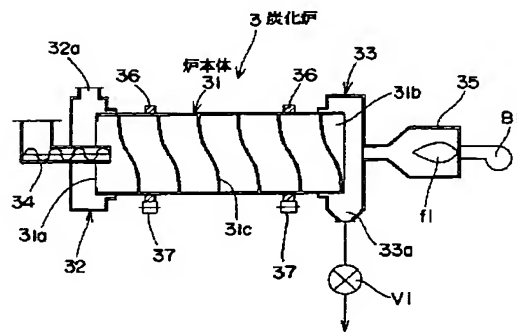
【符号の説明】

- 1 破碎装置
- 2 選別装置
- 3 炭化炉
- 31 炉本体
- 4 賦活装置
- 5 排ガス処理装置
- P1 高分子系廃棄物
- P3 不純物
- P4 破碎物
- A 活性炭

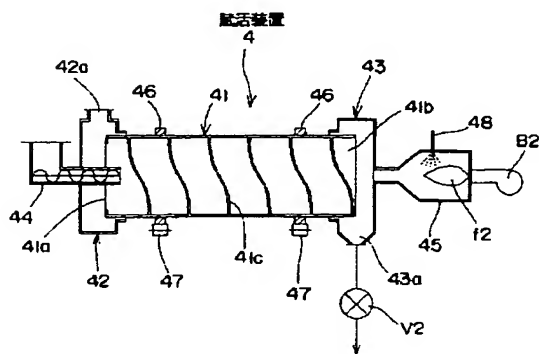
【図1】



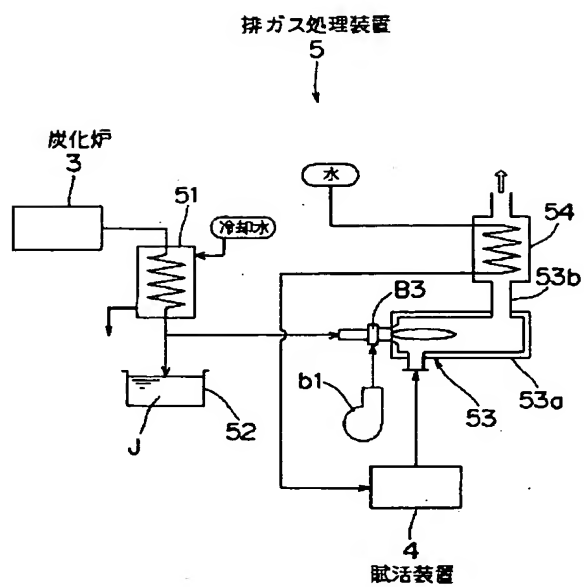
【図2】



【図3】



【図4】



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